REMARKS/ARGUMENTS

Claim Rejections 35 U.S.C. 112

Claims 18, 25-29 stand rejected under Section 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the invention.

With respect to claim 18, the Examiner has argued that it lacks antecedent basis for the term "the clamping pressure". In response, claim 16 is being amended to insert a reference to the clamping step being such as "to apply a clamping pressure". No new matter has been added, and this amendment merely provides a clear antecedent for this term, as used in claim 18.

Additionally, the Examiner had, originally, argued that claim 25 was vague and indefinite. This claim is being deleted.

In claims 26-29, the term "curable elastomeric material" is being replaced with "liquid seal material", so as to be consistent with earlier claims.

Claim Rejections - 35 U.S.C. 103

Claims 1-3, 6, 8, 23, 26-28 and 30 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Chi et al. in combination with Lifferth and Barton et al. This rejection is respectfully traversed for the reasons given below.

The Examiner is first respectfully reminded of the proper requirements for a *prima facie* obviousness rejection, as set out in MPEP 2143:

> *To establish a prima facie case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations.*

Looking at the references cited by the Examiner, Chi et al. is concerned with a fuel cell and the internal connections of fuel cells. The description is notably brief and incomplete. It is largely silent as to how gases or reactants would be supplied to the cell stack. As much as can be determined from the drawings, for each cell, the plates 3

have channels 3a for carrying process gases. These channels merely open on either side of the cell stack. It seems that one set of channels is provided extending in one direction, for one reactant gas, and other channels are provided extending perpendicularly on the other side of the plates for the other reactant. The plates 4, apparently some sort of end plate, are stated to include channels 4b for cooling gases, shown with different dimensions.

Wholly silent is to how gases would be supplied to these channels. It can be noted that on each face of the fuel cell stack, there will be a large number of open channels, and quite how a connection is made to these is not explained.

The Examiner cites a passage from column 1, line 57 to column 2, line 24, the first part of the detailed description for teaching, allegedly, some aspects of the present invention.

What is disclosed in this passage is the provision of some "mechanical and/or chemical means for interconnecting the cells 2". From the drawing, it is clear that the passages 6, shown merely as cylindrical passages through the cell stack, serve no other function than to mechanically attach the plates together, and significantly, they perform no sealing function. The teaching is that some sort of mechanical fastener or plug can be inserted into the cylindrical bore that would extend through the various aligned passages 6 of the assembled stack.

The Examiner does note that there is teaching of using an adhesive material that can be "cured", but again this is merely to bond the cell stack together, and in no sense does this provide any sealing function, for operational fluids and gases.

Reference is made to the potential application of high strength adhesive strips. Again, the sole emphasis here is on providing the necessary strength to bond the stack together, and in any event, there is no teaching that these strips would provide any sealing function, but rather would provide solely a mechanical connection between the elements of the cell stack. One can additionally note that Chi et al. provide nothing in the way of a "groove network" extending through the cell stack, for supply of a seal material. It is submitted that the plain "through passages 6" are not in any way equivalent to a "groove network".

The Examiner also correctly noted that Chi et al. does not disclose that the adhesive (seal) is liquid or that the gas is vented simultaneously as the passageways are filled. The Examiner went on to cite Lifferth et al. for disclosing "a seal made of one or more formed sealant receiving grooves, a fitting connected in to the groove or grooves to allow sealant to be injected there through and a sealant material that can be injected through the fitting into the groove or grooves and that will retain its fluid characteristics while remaining in its assigned position."

Firstly, it is submitted Lifferth et al. is concerned with a non-analogous art. Lifferth et al. is concerned with a seal between two pipes or the like, despite some generic language used. It is submitted that there is no reason why someone concerned with the complex task of sealing a fuel cell stack, where there might be, for example a hundred cells, would turn to the art of pipe seals, to look for a useful seal assembly.

As stated in MPEP 2141.01(a), "In order to rely on the references as a basis for rejection of an applicant's invention, the reference must either be in the field of applicant's endeavor or, if not, then be reasonably pertinent to the particular problem with which the invention is concerned" (citing re: *In re Oetiker*, 977 F.2d 1443, 1446, 24 USPQ2d 1443, 1445 (Fed. Cir. 1992), and other cases). It is further noted that "a reference is reasonably pertinent if, even though it may be in a different field from that of the inventor's endeavor, it is one which, because of the matter with which it deals, logically would have commended itself to an inventor's attention in considering his problem" (*Wang Laboratories Inc. v. Toshiba Corp.*, 993 F.2d 858, 26 USPQ2d 1767 (Fed. Cir. 1993)). It is submitted that, in this case, Lifferth is not analogous art.

Critically, Lifferth teaches the use of a liquid seal material that remains in a liquid state. This aspect of this reference is pertinent both to the question of whether it is analogous art and whether it would have "commended itself" to the present inventor, and also to whether in combination all the features of the present invention are taught. It is submitted that the answer to both these questions is in the negative; to use a liquid seal in a fuel cell stack has, to applicant's knowledge, never been suggested and would be wholly impractical where one is attempting to seal a large number of components together and prevent leakage between various reactant gases and commonly a coolant

(the presence of an additional liquid in the stack would merely complicate the problem); as it teaches a liquid seal material, specifically taught to remain in a liquid state, it clearly does not teach all the features of the present invention.

The Examiner then cited Barton et al. for disclosing an improved MEA having the resilient fluid impermeable integral seal. All Barton et al. teach is the making of individual and discrete seals, separately from the assembly of the stack itself. As detailed in the introduction of the present specification, various techniques are known. Thus, in many fuel cell stacks, entirely separate seals are provided, which may be either molded, cut from sheet material or otherwise formed. It is also known, somewhat as in Barton et al., to mold individual seals onto individual plates or other elements of a fuel cell stack.

What all these techniques still require is that the individual elements of a stack be assembled, that seals be properly aligned, and that tolerances be such as to ensure adequate sealing. Again, where there are, possibly, hundreds of separate elements and seals, this is extremely difficult to achieve. If anyone seal is imperfect, then the whole stack has to be disassembled, disrupting all the seals, and another attempt made at assembling the stack and obtaining perfect seals throughout.

The Examiner refers to column 5, lines 13-30 for teaching that the "fuel cell stack is assembled and placed inside a mold wherein the curable flow processable sealant material is introduced into the mold and is directed to the sealing regions of the MEA and impregnated into a portion of the seal regions and then cured to form the integral seal, upon which the MEA is removed from the mold". The first statement of this quoted passage is wholly incorrect; there is no teaching that the whole or entire "fuel cell stack" is assembled and then placed inside the mold. Rather, all this passage teaches is the known technique of molding or forming a seal on <u>one</u> or a discrete element of the stack. Thus, step (a) of this method (column 5, line 16) requires "placing the MEA inside a mold". To emphasize, the teaching here is that just the MEA by itself, and no other element, is subject to this molding step. Once the seal is molded, the assembly steps still need to be completed. This feature is emphasized in the embodiment of Figure 3b which discloses an "alignment feature in the form of a

cylindrical plug or pin 162" (column 7, lines 56 and 57). This is only required because, again, the seal is molded separately, and the elements still have to be assembled later.

One can also note Figures 4a-4c will show how an integral seal is compressed between two fuel cell separator plates (column 8, lines 29-46). This again reinforces the basic concept behind this invention that it is still necessary to assemble the separate elements of the stack. Figures 4b and 4c seem to show plates specifically configured to accommodate compression and displacement of the seals.

None of this is required or present in the present invention, where the invention has, as a first step, assembling the separate elements of the stack together. Only after assembly, is the seal material injected, for forming bonds between adjacent and abutting elements of the stack. No such technique is anywhere taught in Barton et al.

Turning to the Examiner's analysis of how it would be obvious to combine these references together, the Examiner argued that, while Chi et al. does not disclose a liquid adhesive, it would be obvious to use a liquid adhesive from Lifferth. It is submitted that there is simply no reason or basis for introducing the liquid seal material of Lifferth into Chi et al. Chi et al. is quite clear in teaching that the final seal must be solid. It provides no groove arrangement or the like that would completely enclose a liquid seal. In short, a skilled person would have absolutely no reason or basis for contemplating introducing a liquid seal, as from Lifferth, and no motivation to do this. There would be no expectation of any sort of success. Introducing a liquid seal would only introduce the possibility of another liquid material that could leak, rather than solving the sealing problem.

With respect to the venting of gas issue, again, since Chi et al. are concerned with a wholly different sealing technique, and generally seems to disclose a stack that is open in various respects, there would be no reason or basis to consider providing a groove network with venting as in the present invention. The simplistic seal arrangement of Lifferth would not commend itself as any possible solution or starting point for solution to the complex sealing problem of a fuel cell stack.

The Examiner indicated that the prior art of Barton et al. was cited for its teaching of the particular injectable sealant materials and for the alignment of the MEA to the separator plates. What this overlooks is that Barton et al. specifically teach away from the present invention, in that it teaches the formation or molding of a seal on an MEA as an independent step, and only after forming and molding the seal, does Barton et al. suggest that the individual elements be assembled together.

Additionally, as noted above, any theoretical combination of the three references fall short of the claimed invention and does not disclose all the features of claim 1 and other claims. As noted above, none of these references disclose a groove network for distributing a liquid seal material through a fuel cell stack. Even if one accepts the Examiner's combination of Lifferth and Chi et al., one at best would end up with a fuel cell stack having, somehow or another, a liquid seal material distributed through it; there is no teaching that his liquid seal material be cured; rather, the teaching in Lifferth is exactly the opposite that it should be maintained in a fluid or liquid state.

Accordingly, it is submitted that the Examiner has failed to make out a *prima facie* case of obviousness with respect to the cited claims, and is requested to withdraw this rejection.

Claim Amendments

With a view to clarifying the claims, a number of amendments have been made to the claims, summarized below, these amendments being entered to clarify the claims and not for reasons of patentabiliity.

Firstly, the application as a whole and the original claims anticipated application of the invention to fuel cells as a class of electrochemical cells and electrochemical cells generally. Thus, original claim 30 was directed to a method of forming a seal in an electrochemical cell assembly. For clarity, claim 1 has been revised to refer to an electrochemical cell.

Original claim 24 anticipated that the cell assembly could include two groove networks for two different seal materials. For consistency within the claims, claim 1 and elsewhere is now being amended to refer to "at least one" groove network.

Original claims 27 and 28 anticipated that the seal material could either be elastomeric material such as epoxy resin or a thermoplastic elastomer. See also the passage in paragraph 161 of the specification. As is well know, a thermoplastic elastomer, by its very nature, does not "cure" in the sense of undergoing an irreversible chemical reaction when it passes from a liquid to a solid state. Rather, by definition, a thermoplastic elastomer is a material which can be heated to render it liquid, and then cooled to harden it. Accordingly, for clarity, claim 1 has been amended to remove the reference to curing, and now refers to the material being caused to "set". Paragraph 161 is being amended correspondingly

It is submitted that all these amendments are wholly consistent with the original disclosure, and that no new matter has been added.

Following the amendments to claim 1, consequential, minor amendments are being made to claims 2 and 3.

In view of the Examiner's allowance of claim 9, this claim is being put into independent form.

Claim 16 has been amended to introduce an antecedent for the term "clamping pressure".

Further to the comments above on claims 27 and 28, these claims have been revised. Firstly, they now, more correctly, refer to "the liquid seal material", and the setting action in each case is now clarified. As for claim 1, claim 30 has been revised to refer to "at least one groove network", and also to the seal material being caused to "set". Additionally, in claim 30, it is specified that the seal formed in the groove network such as "to define at least one chamber for a fluid for operation of the electrochemical cell assembly". No new matter has been added.

New claims 31 and 32 generally correspond to claims 27 and 28, but are dependent from claim 30.

Allowable Subject Matter

The Examiner had indicated that claims 4, 5, 7, 9-17, 19, 20-22 and 24 were allowable over the prior art of record, and were only objected to as being dependent upon a rejected base claim.

As detailed above, claim 9 is being put into independent form. The other allowed but objected to claims, are not, for the time being, being put into independent form, since as submitted above, it is believed that these claims are in order for allowance.

Accordingly, early review and allowance are requested.

Respectfully submitted,

BERESKIN & PARR

By _____

H. Samuel Frost
Reg. No. 31,696
Tel: 416-364-7311